

MetriLink Wireless System

M392 Rev A

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Important Information to User

- Changes or modifications not expressly approved by the manufacturer may void the user's authority to operate the equipment.
- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.
- This device is for mobile and fixed use only (not portable or body-worn). A separation distance of 20cm must be maintained at all times between the antenna and the body of the user and bodies of nearby persons.
- This device has been designed to operate with an antenna having a maximum gain of 9 dBd. Any antenna having a higher gain is not permitted under the FCC license. The required antenna impedance is 50 Ohms.

FCC Certification

- This product is a frequency hopping RF transceiver module for the 2.4GHz ISM band, designed to meet FCC 15.247, and is used in industrial control and monitoring applications.
- The antenna is factory supplied and **MUST NOT** be exchanged or modified by user.

This document cannot be changed without prior FM approval

JOWA USA, Inc. reserves the right to update or change this user guide at anytime. For the most recent version of the user guide, please check our website:
www.jowa-usa.com

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Rev	Date	Notes	Initials

Software Compatibility

Software for JOWA USA is revised periodically. Internal device software may contain portions that are not compatible with previous versions of Wireless software.

To ensure software compatibility, ensure that all Field Units and the base are running the same version of software. Special attention to this must be paid when adding new units to an existing system. If you believe you are experiencing software compatibility issues please call JOWA USA's Customer Service at (978) 486-9800 or email info@jowa-usa.com.

Web Browser compatibility

The MetriLink Base Radio web server is compatible with the following browsers:

Internet Explorer v. 10 and later

Chrome v. 33 and later

Firefox v. 28 and later

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1.0 Introduction

1.1 Using this Manual

This manual is designed to assist in installing, operating, and maintaining the JOWA USA MetriLink wireless system. The manual is broken into sections as follows:

1 Overview

This section describes the general layout of the system.

2 Unpacking

This section covers steps to take when receiving the system and what to check prior to starting the setup and installation.

3 Quick Start

This section summarizes what must be done in order to get the device installed, configured, and in operation quickly. However, it does not provide detailed or how-to information to perform the tasks outlined.

4 Installation

This section explains mechanical installation and correct wiring for power and communications.

5 General Configuration

In this section the establishing of network connection over Ethernet is described. Thereafter comes description on how to log on and set up password protection.

6 Configuring the RF Communications

This section covers the setup of the Radio RF Communications that allow the Base Radio to communicate with Field Units that have been placed in service. It furthermore describes how to add units and ensure reliable RF connectivity.

7 Setting up the data delivery

This section covers how to configure update frequency and what data to deliver. Also covered in this section is a brief discussion of how data is displayed, logged and exported.

8 Technical Specifications

This section explains the technical specifications that are associated with this device, such as power characteristics, accuracy, and operating characteristics.

Throughout this manual there are warnings, cautions and notes to highlight important items.



Note: Notes are information that are of special importance warranting additional attention.



Caution: These describe items that could cause minor difficulties if not handled properly.



Warnings! highlights settings and features that can create serious problems if mistakes are made. Pay special attention to these to avoid unnecessary troubles and wasted time.

2.0 Overview

The MetriLink Wireless System is a reliable Radio Frequency mesh network consisting of one Base Radio accessed thru an Ethernet port and one or several Field Units that when coupled with a resistance-tape level sensor it can be used to monitor a variety of tanks or processes. The time and expense of running wires often makes it difficult to measure parameters that have an economic impact on your plant operation, but the MetriLink Wireless System allows you to quickly and accurately monitor those levels at fraction of the cost, which gives you faster returns on your instrumentation investments.

The Field Units communicate in a secure, digital protocol over a band of frequencies in the 2.4GHz spectrum. This data communication technique is one of the most widely used standard for today's digital communication. These devices require no wires, permits or licenses, and are easily setup and installed right out of the box.

You can use this device for long term monitoring in remote locations, for short-term data gathering on process conditions, or to quickly test the economic viability of a new installation.

The purpose of this Guide is to help you install and maintain your MetriLink Wireless System.

2.1 About the Device

The JOWA USA MetriLink Base Radio is a reliable Radio Frequency (RF) transceiver that communicates with the Field Units over a 2.4GHz mesh network and is accessed with a web browser and an Ethernet network.

3.0 Unpacking

Remove the Packing List and check off the actual equipment received. If you have any questions on your shipment, please call the factory. Upon receipt of shipment, inspect the container for any signs of damage in transit. Especially take note of any evidence of rough handling. Report any apparent damage immediately to the shipping agent.

Please note that sometimes units are assembled with accessories when shipped. Inspect the shipment carefully if you think that something is missing. This is rare, as we take considerable care to pack units for shipment, but it does sometimes happen. Please give us a call and we may be able to resolve this matter quickly over the phone.



Note: Please note that the carrier will not honor any claims for damage unless all shipping materials are saved for their examination. If damage is found during examining and removal of the contents, save the packing material and the carton.

4.0 A Quick Start Guide

This section summarizes what must be done in order to get the device installed, configured and in operation quickly. Additional detailed information is found throughout this guide.

4.1 Base Radio

The Metrilink Base Radio (shown in Figure 1) is a rugged and powerful embedded connectivity appliance built to interface directly to a mesh network of JOWA USA Metrilink components.

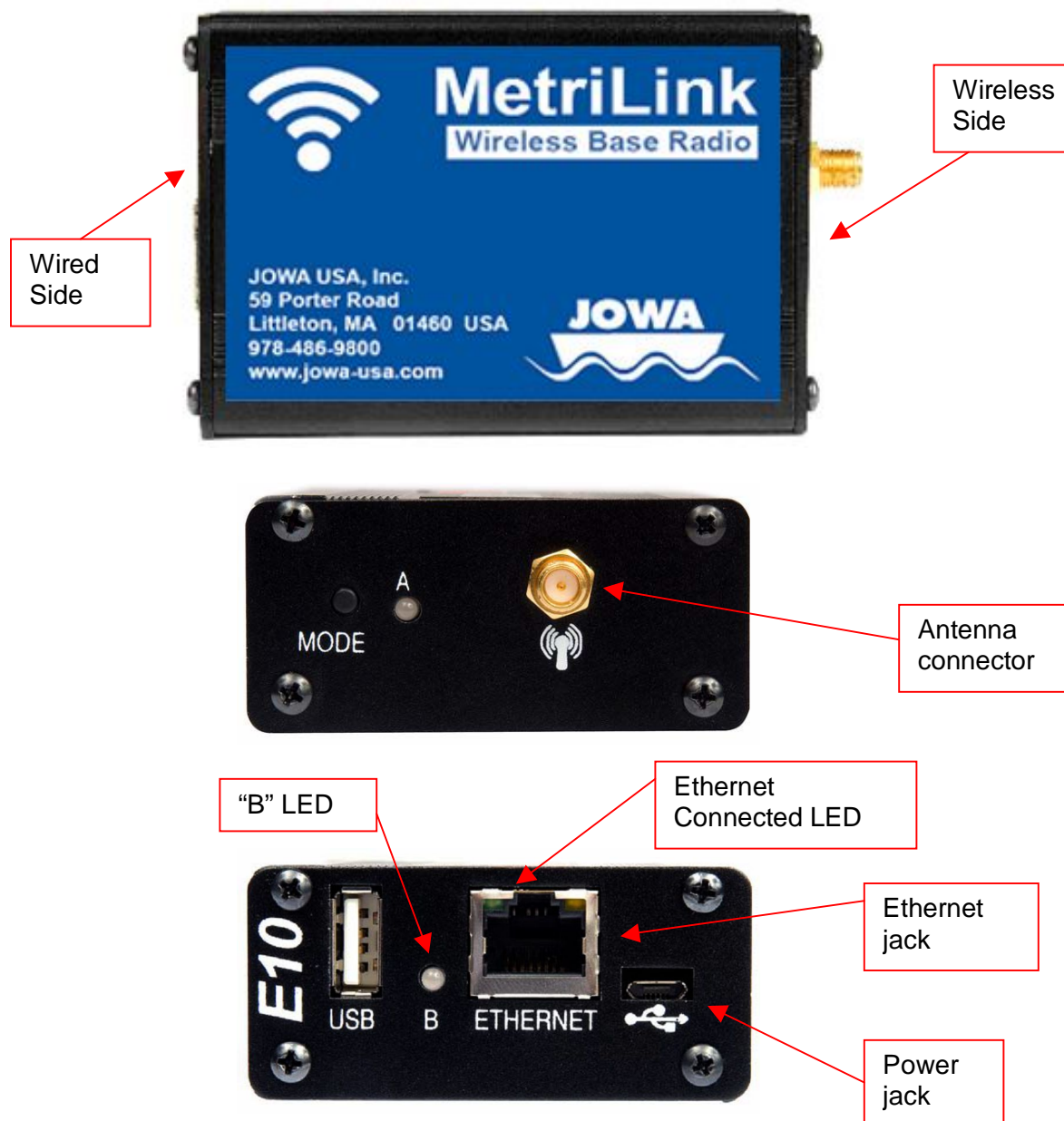


Figure 1

To get the system up and running quickly, follow the steps below:



Note: If you are unsure how to perform a task please read the appropriate user manual section.

1. Wire 5VDC power to the Base Radio using the provided wall plug power supply and cable.
2. Attach the antenna to the antenna connector.
3. Connect the Base Radio to an Ethernet network with a DHCP server. The Base Radio can also be connected directly to a PC using an Ethernet crossover cable.
4. Open a browser on a computer on the network and establish connection with the Base Radio using the IP address assigned by the DHCP server. If you have connected Base Radio directly to a PC the default static IP address of the Base Radio is 192.168.1.111.
5. When connected the Base Radio login page appears. Log in using the default username "wireless" and password "metritape".
6. We recommend that you create a new admin user and password. Click on the Admin menu and then Create New User button. Make sure you select the Admin box. Log out and log in as the new admin and remove the default user by first selecting that user and then selecting remove.
7. The default Metrilink RF settings should work well for most applications. If you do not have other Metrilink hardware within range you should be able to leave the default settings. The update frequency is set to 2 minutes from the factory and you may want to change this to suit the application. This is done under the Setup / RF Network menu. Change the sleep period to the desired amount. The program sets the other timing values and we recommend that you do not alter them.
8. Go to the Setup / Field Units page and proceed to add the Field Units.

If you are not successful connecting your browser to the Base Radio check the following:

- Do you have power to the unit? You should be able to see an orange glow inside the box if you look thru the cracks around the Ethernet connector. The "B" LED should blink green every 2 minutes. Finally, unplug and replace the power plug and observe the "B" LED. It should be off for 15 – 35 seconds and then go red and then green briefly before settling into the slow steady blinking green.
- Is the green LED on the Ethernet connector lit? If not, check that you have a good connection the Ethernet network. In addition to the steady green LED the orange activity LED should be blinking.
- Verify with your network administrator that you have the right IP address. Can you "ping" this address from your PC? See section 5.3 on how to use the ping command.
- You can connect a serial terminal to the Base Radio thru the miniUSB connector for further diagnostics. See section 8.4 for details on this.

4.2 Field Units

Once the Base Radio is set up, follow the steps below to add the Field Units:



Note: If you are unsure how to perform a task please read the appropriate user manual section.



Note: We recommend that the Field Units be located close to the Base Radio and adjacent to a PC with a browser connected to the Base Radio when they are powered up and added to the network.

1. Ensure that the Base Radio is powered up and you are connected to it with a browser. Ensure that the RF channel of the Base Radio is set to channel 4. (If you are using different channel and or non standard RF parameters the Field Units must be set up prior to connecting them to the RF network.)
2. Install the antenna to the connector on the Field Unit.
3. Unscrew the 4 screws and remove the lid of the Field Unit.
4. Plug in the battery's connector to the 3-pin header on the circuit board. Pay attention to the orientation of the connectors. One pin is removed and one terminal is blocked to prevent incorrect connection.
5. Read the last 4 characters of the MAC address on the RF module. The MAC address are the 16 hex digits [0-9 and A,B,C,D,E and F] printed on the white label.
6. Check the browser on your PC. Navigate to the Setup / Field Units page. A list of groups will appear (if it is a new system then only the "Inactive" group will exist). Create a new group by clicking on "Create New Group" button and give it a name. (Data from Units in the Inactive group can not be viewed or tracked).
7. Click on the radio button for the "Inactive" group and a list will open showing the Field Units in this group. The newly powered Unit should be in the list. Click on "Edit Field Unit" button and then select the desired Field Unit with it's radio button and a Field Unit edit panel will open. Here the Unit can be given a name and be assigned to a group (it must be assigned to a group other than the "Inactive to be used").
8. Below this there are two rows of check boxes. Top row is "for which values you want to have displayed on the "Live" page. Second row defines which values to be recorded. Recorded values can be viewed on the "Logs" page and also exported to external files. Check the boxes as desired. Save the settings with the "Save" button.
9. Finally click on the "Change Tank/Sensor parameters" button to enter the setup and calibration values. Finish by clicking "Save". Currently all setup units are in metric units only.
10. We recommend leaving the lids off until connection to the Base Radio has been verified with the Field Unit at the intended final location.
11. Repeat step 2 thru 10 for the remaining Field Units.

If a Field Unit is not appearing on the Field Unit List tab and is listed as True, check the following:

- Is the battery good and is the battery connector plugged in correctly?
- Is the Base Radio set to channel 4?

- Is the Field Unit set to the default channel (channel 4)? In order for the Field Unit and the Base Radio to communicate they must be on the same RF Channel, and must also use the same network ID and encryption key (if encryption is used). If you are not sure, see section 8.2 for procedure to reset the Unit.
- Are the Base Radio and Field Units unable to communicate due to obstructions or distance? (See Field Unit Guide: Field Unit Placement section)



Warning! If the Field Units have been running for an extended period of time with no signal from the Base Radio (the Base Radio is off or not present), the Field Units will enter an extended sleep mode. Sleep times can be in excess of 30 minutes. Turning the Field Units off and back on will cause them to transmit to the Base Radio immediately.

- Did you perform the Simple RF Placement Test? (See Field Unit Guide: A Simple RF Placement Test section).
- While all Field Units and Base Radios are set to default configurations at the factory, if any configuration differences are present the Field Unit will not be able to communicate to the Base Radio. If you are unsure we recommend setting the Base Radio to channel 4 and turning off encryption. Reset the Field Unit(s) by following the process described in section 8.2. This will ensure the default values are used.



Note: During configuration and installation, keep Field Units at least one foot apart and away from the Base Radio to ensure good communications.

5.0 Base Radio Installation

This section covers the mechanical and electrical aspects of installation.

5.1 Mechanical Installation

The MetriLink Base Radio is a rugged device, which provides optimal performance when installed with careful consideration. Installation practices affect the life that you can expect from your MetriLink Base Radio. The main considerations for installation are covered below.

Give careful consideration to the environment where you will be installing the devices. Avoid installations that expose the device to excess temperature, high vibration, considerable shock, or exposure to dripping condensate or corrosive materials. Also avoid installing the device in an unserviceable location.

Most often these problems can be avoided with some thought at the time of installation. The practices noted below are generally recommended, but they can only act as guidelines and cannot cover all possible variations.

The final installation must be made at the discretion and approval of the user. You must be the judge of the actual installation.



Warning! During installation do not apply force to the instrument housing or antenna. Use a proper wrench for all installations. Failure to use correct installation procedures can cause damage to the Base Radio.

Base Radio Positioning

Correct positioning of the Base Radio will ensure the best performance of the device. Because the Base Radio is the central communication device of all Field Units that are assigned to it, the Base Radio should be located in an area that is somewhat central to all of the Field Units.

Place the Base Radio in a dry location with ambient temperatures of -40°F to 185°F (-40°C to 85°C).

Make sure you have power and communication to the Base Radio available (see Electrical Installation).

Keep in mind also that the approximate line of sight range between a Field Unit and Base Radio is nominally 3000' with the data rate set to 250 kbps. Higher data rates will reduce this range.



Note: This range is reduced by the amount of RF noise present, obstructions and the material properties of those obstructions.

Figure 5-1 is a picture of a general Base Radio layout. The maximum distance is determined by a number of factors, including the Baud Rate Setting. When planning the positioning of the Base Radio, try to place the Base Radio in a location with an unobstructed view to the most Field Units possible.

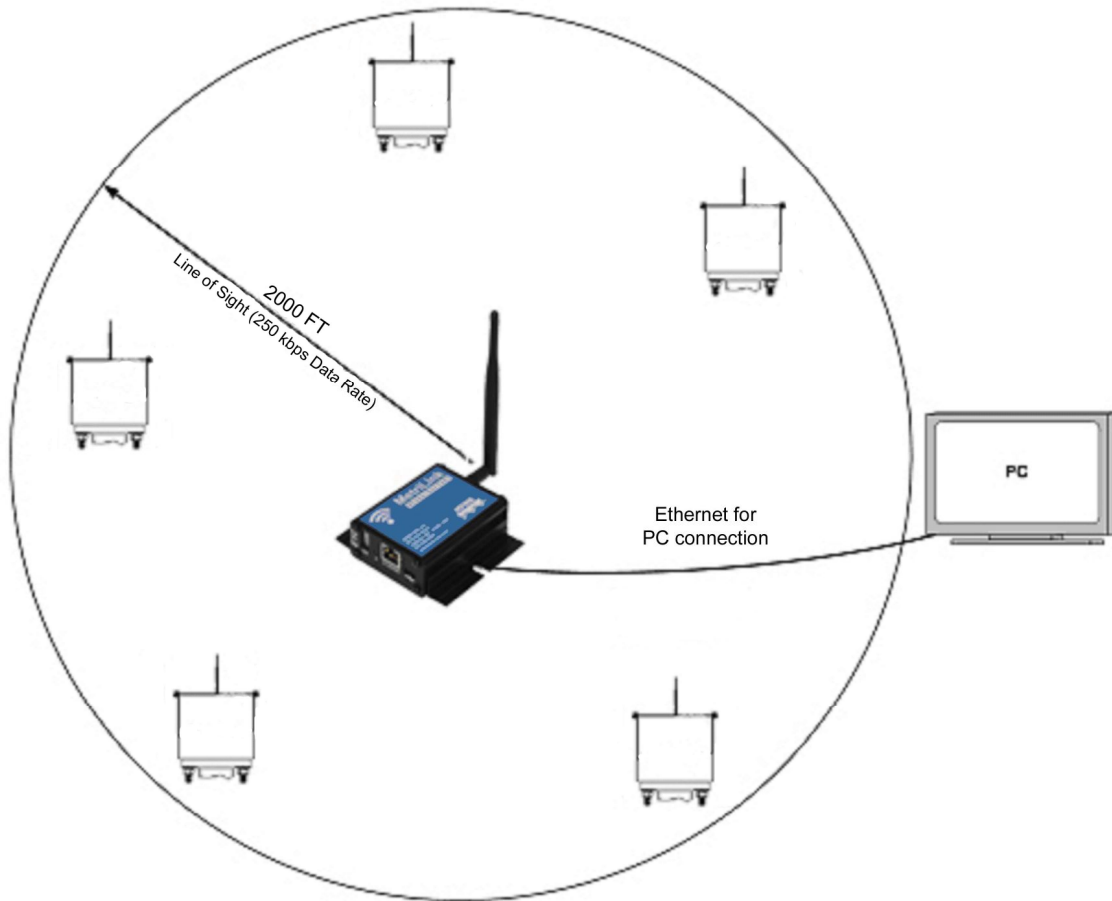


Figure 5-1 General Layout

Because there are so many setup possibilities we cannot cover them all. A correct setup would make sure that the above warnings are heeded and that the Field Unit and Base Radio are capable of communication. The RF Placement Procedure section of the Field Unit Guide will help you to determine if you have selected the correct installation points and orientations for your application.

5.2 Electrical Installation

Electrical Specifications

- 5VDC Power Supply with 0.5 Amp minimum output
- RJ-45 Ethernet jack and Micro B USB for Communications

Wiring Power to the Base Radio

The JOWA USA Base Radio is designed to use a 5 VDC power supply at a minimum of 0.5 Amps. One wall plug style power supply is provided with each Base Radio.

High Gain Antenna

High-gain antennas is available for the Base Radio. Depending of the type these antennas can possibly double the signal range of the Base Radio, but some are directional and will require special considerations with regards to positioning.

5.3 Base Radio Configuration

This section covers the detailed steps to configuring the Base Radio via the Ethernet connection.

Establishing connection to the Base Radio

To configure the Base Radio an Ethernet connection must be established using a web browser. The MetriLink Base Radio can be accessed with Chrome v 33, Firefox v. 28 and I.E. v 10 and later.

To connect to the Base Radio, the IP address of the Base Radio needs to be determined.

The Base Radio is set up from the factory to request a dynamic IP address from the network. If a request for an IP address is not answered it will default to a static address. The static address is set to 192.168.1.111.

Dynamic IP address

If the Base Radio is connected to a dynamically addressed network the IP address is set by the network DHCP server. The address assigned can be obtained from the server.

It is also possible to get the current IP address from the Base Radio by querying it using a serial terminal. See section 8.4 for details.

Static IP address

If a dynamic address is not assigned by the network server the Base Radio will use the default static address. This address is set to 192.168.1.111 by a configuration file in the Base Radio.

It is possible to change this static IP address by editing the setup file with a serial terminal. See section 8.4 for details.

Accessing the Base Radio

Viewing data, performing setup tasks and diagnosing the Base Radio is done thru a web interface using a web browser.

Open a browser and enter the IP address in the address bar. You should see the login page. Enter your user name and password to enter.

If it is the first time logging in then use the default username “wireless” and password “metritape”.

If you do not see the log-in page see section 7 on how to diagnose network connection issues.



Note: To access the web page the first time use “wireless” as user name and “metritape” as password to log in. Do change this promptly to prevent unauthorized access.



Warning! Before the default log-in account is deleted, be sure to set up and test a new admin account. Be sure to write down this new log-in name and password. If you loose or forget this info, access to the Base Radio may no longer be possible. In this case the Base Radio will have to be reset and all setup info and logged data will be lost.

Changing static IP address on your PC

If you have the Base Radio connected directly to a PC thru a Ethernet crossover cable you need to set your PC's static IP address. This address must have the same first three groups of numbers as the static IP address of the Base Radio. The fourth and last group of numbers must not be the same. The Base Radio's default static IP address is 192.168.1.111. We recommend that the PC's address is set to 192.168.1.112.

To set the static address open the “Network Connections” that can be found in the “Control Panel”. Open the “Local Network Connection” (if you have more than one, select the one associated with the port that the Base Radio is connected to), click on “Properties”, scroll down the list to “Internet Protocol (TCP/IP), select this line and click on “Properties. Click the tab “Alternate Configuration”, then select “User configured” and enter the IP address in the top field. Enter 255.255.255.0 as Subnet Mask and click “OK”. The window closes and you are returned to the previous window. Again click “OK”. (It may take a long time before the settings are saved and the window closes, be patient. Your PC's static IP address is now set.

To verify the above, click on the start button at the bottom left of your screen and; for Windows 7 type cmd in the search box and press enter; for Windows XP select “Run”, type in cmd.exe and click “OK”. A black terminal window will open. In the window type ipconfig/all and hit “Enter”. You should get a reply with the selected IP address as below. The “Ethernet adapter Local Area Connection” should be 192.168.1.112


```
C:\WINDOWS\system32\cmd.exe
G:\>ipconfig/all

Windows IP Configuration

    Host Name . . . . . : poh-t61
    Primary Dns Suffix . . . . . : jowa-consilium.local
    Node Type . . . . . : Broadcast
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : jowa-consilium.local
                                      jowa-consilium.local

Ethernet adapter Wireless Network Connection:

    Media State . . . . . : Media disconnected
    Description . . . . . : Intel(R) Wireless WiFi Link 4965AGN
    Physical Address. . . . . : 00-13-E8-B7-55-ED

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : jowa-consilium.local
    Description . . . . . : Intel(R) 82566MM Gigabit Network Con
nection
    Physical Address. . . . . : 00-1C-25-14-73-C9
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 192.168.10.121
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.10.36
    DHCP Server . . . . . : 192.168.10.11
    DNS Servers . . . . . : 192.168.10.11
    Lease Obtained. . . . . : Tuesday, May 20, 2014 5:47:27 PM
    Lease Expires . . . . . : Wednesday, May 28, 2014 5:47:27 PM

C:\>
```

Note also that the PC reports if the DHCP server has provided an IP address.

Now type ping 192.168.1.111 and hit "Enter"

You should see the reply:

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\poh>ping 192.168.1.111

Pinging 192.168.1.111 with 32 bytes of data:

Reply from 192.168.1.111: bytes=32 time<1ms TTL=64
Reply from 192.168.1.111: bytes=32 time<1ms TTL=64
Reply from 192.168.1.111: bytes=32 time<1ms TTL=64
Reply from 192.168.1.111: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\poh>_
```

You are now ready to open the browser and enter 192.168.1.111 in the address bar.

Setting up log-in accounts

We recommend starting the setup process by setting up a new administrator log in and deleting the default one.

Log-in accounts

The MetriLink Base Radio supports multiple log in accounts. There are three levels of users; Read, Write and Admin. Only Admin users can set up new user accounts. The default user “wireless” with “metritape” as password is an administrator account.

Read users can only read data and some setup info. They are not able to view, add or change other users names or passwords. They can change their own password.

Write users can perform all tasks except that they are not able to view, add or change other users names or passwords.

Adding a new log-in account

To add a new account, log in as an administrator and click on the “Admin” button. Click on “Create New User”, enter the new name and password and check the appropriate user type box then click the “Create” button.

Editing a log-in account

To edit an account, log in as an administrator and click on the “Admin” button. Select the user to be edited and a panel will open up with the users information. Make the desired changes and click the “Update Button”.

Deleting a log-in account

To delete an account, log in as an administrator and click on the “Admin” button. Select the user to be deleted and a panel will open up with the users information. Click the “Remove” button and the account will be removed and the panel will close.

5.4 Configuring the RF Communications

All Field Units and Base Radios can be set to one of 16 different communication channels. The only Field Units recognized by a particular Base Radio are the units that share the same RF Channel as that Base Radio. This allows the user decide which Field Units communicate with each Base Radio when more that one network is used.

Each Field Unit comes from the factory set to channel 4. This means the Field Unit will only communicate with Base Radios set to channel 4. If your Base Radio is using a channel different than 4 and you did not order your Field Unit(s) with your non standard channel you will need to take extra steps to add it to your network.

In addition to the 16 RF channels MetriLink systems can be separated using separate network IDs. There are more than 65,000 different IDs to choose from. The ID is a 4 character hex number and the default is 1C2C.



Note: Changing network ID is not implemented in firmware version 1.18. It is planned for future versions. Contact JOWA USA if you are interested in this feature.

Selecting separate channels thus using different physical frequencies will reduce bandwidth congestion and possibly increase performance if many units are coexisting.

Using different network IDs will prevent units from communicating but will not reduce the congestion on the channel.



Note: Only radios, Base Radios and Field Units, on the same channel, using the same channel ID and the same AES encryption key will be able to communicate with each other.

Encryption

The MetriLink radios are able to communicate securely using 128bit AES encryption. This will prevent unauthorized reception of Field Unit data and changes to settings.



Warning! If channels, network IDs and/or AES encryption keys gets set differently or the settings of Field Units are lost or forgotten a reset will be required. This process can be very cumbersome if the Units are deployed.



Warning! If proper care is not taken when changing RF parameters it is possible to have the process completed only partially. This may result in units with different channels and inability to communicate with the complete system.

Changing RF channel, Channel ID and/or Encryption Key

If it is desired to change the channel follow the procedure below:

It is strongly recommended not to change RF parameters after the units are installed. Best to make the changes at the time of commissioning with the Field Units open and close to the Base Radio.

If it is desired to change the channel follow the procedure below:

- Ensure that all Field Units are communicating with the Base Radio. This can be seen on the Live or Setup / Field Unit pages.
- Verify also that the signal strength for all units is at least 30%. This can be seen on the "Diagnostics" page.

- We recommend as an additional precaution to shorten the sleep periods prior to the channel change. This will greatly simplify the recovery should the change be incomplete or get interrupted. Make note of the current sleep and wake settings then click on “No” for “Autofill Timeout Parameters”, set the Wake and Timeout Wake Periods to 2s and Sleep and Timeout Sleep Periods to 6s. Once the channel change is complete the timing values can be reset to their original values.
- Navigate to the “Setup / RF Network” menu. Click on the radio button to the left. A Network Update panel will open up.
- Make the desired changes. Click “Save”.

Quincy Process & Mfg. Co.

MetriLink Wireless Monitoring System

Live Logs Setup Diagnostics Admin Log Out

RF Network Status: ■

Select	Channel	Data Rate	AES Enable	Wake Period,s	Sleep Period,s	Timeout Wake Period,s	Timeout Sleep Period,s	Firmware	Software
<input checked="" type="radio"/>	7	250 Kbps	Off	2.0	4.0	4.0	8.0	2.4.22	BASE_1.11

Network Update

Channel:

Data Rate:

AES Enable: ☐ On ☒ Off

Autofill Timeout Parameters? ☒ Yes ☐ No

Wake Period:		Sleep Period:		Timeout Wake Period:		Timeout Sleep Period:		Estimated Battery Life:
Seconds	Minutes	Seconds	Minutes	Seconds	Minutes	Seconds	Years	
<input type="text" value="2.0"/>	<input type="text" value="0"/>	<input type="text" value="4.0"/>	<input type="text" value="0"/>	<input type="text" value="4.0"/>	<input type="text" value="0"/>	<input type="text" value="8.0"/>	<input type="text" value="0.15"/>	

Battery Constants

Change Battery Constants? ☐ Yes ☒ No

Software Update

Update Base Software? ☐ Yes ☒ No

A command to make the change(s) will be sent to all Field Units. Once all units have acknowledged receipt of command, a reboot command will be sent that will execute the change. Finally the settings of the RF module in the Base Radio will be switched and the change is complete.

Not until the above procedure has been completed will the channel listed on the Base Radio status line change.



Warning! All field units in communication with the Base Radio will be issued the change(s). Do not make changes to RF parameters if “alien” Field Units have been accidentally assigned to Active Groups. See section 6.5 on how to resolve this issue.

5.5 Sleep Timing

The Field Unit is in a “sleep” mode to save power during the idle periods between communications. This mode turns off most of the electronics on the unit, with the exception of the timer, in order to preserve battery life. The Field Unit will then ‘wake up’ once the **Sleep Period** elapsed. Once awake it will take the required measurement(s) and make the transmission to the Base Radio. The Field Unit will then transmit these readings to the Base Radio. Each Field Unit will also listen for other Field Unit’s data transmissions and relay them if needed. Finally, Field Units will wait for the sleep command from the Base Radio after which the process will repeat.

Sleep Time can be set to any value above 5s. Longer Sleep Times will prolong battery life and will increase delay in data reporting.

Default Sleep Time is 2 min. This will under normal circumstances yield a better than 3 year battery life. The relation between Sleep Time and battery life is not linear but for planning purposes the below guideline can be used.

Sleep Time	Battery Life	Sleep Time	Battery Life
2 min	3 years	15 sec	9 months
1 min	18 months	5 sec	3 months

Prolonged sleep and wake during lost communication

The MetriLink system operates as a mesh network where radios seamlessly relay messages whenever the need exist. This requires that all Field Units have their sleep cycles synchronized. Should a Field Unit loose contact with the mesh it will enter a recovery mode. During recovery it will sleep "Timeout Sleep Period" and stay awake "Timeout Wake Period" (see Setup / RF Network page) until communication with the mesh has been re-established.

By default the "Timeout Wake Period" is set equal to "Sleep Period". This ensures that the Filed Unit will be awake when the mesh next wakes up. It will then receive the sleep command from the Base Radio and will resynchronize itself with the mesh.

To prevent unnecessary battery drain during recovery mode the "Timeout Sleep Time" will be set to have the same ratio to the "Timeout Wake Time" as the "Sleep Time" has to the "Wake Time".

For example; Default wake and sleep times are 2s and 120s. Ratio is 60:1. The default timeout wake and sleep times are 7200s (2 hours) and 120s. Ratio is 60:1.

To reduce this potentially long recovery time the "Timeout Sleep Period" can be set lower. One consequence of this is an increased battery drain during lost communication.

It is not recommended to reduce the "Timeout Wake Period" below "Wake Period" unless all Field Units are within reliable range of the Base Radio as Field Units can be permanently lost by the mesh. Recovery can be achieved by cycling power to the Field Unit while it is within range of the Base Radio.

Setting the Sleep Timing Values

Carefully consider how often data updates are required for desired operation and whether the default "Timeout Wake Period" and "Timeout Sleep Period" needs to be changed, then follow the steps below to set the timing parameters.

- Ensure that all Field Units are communicating with the Base Radio as shown by their green bar graphs. Communication status can also be seen on the Setup / Field Unit pages. Look for the "Present" column. Communication units will be shown as "True". Non communicating ones as "False".
- Verify also that the signal strength for all units is at least 30%. This is shown on the "Diagnostics" page.
- Navigate to the "Setup / RF Network" page. It might be necessary to click on the radio button to the left. A set-up panel will open up.
- Make the desired changes. Click "Save".

Examples:	Wake Period	Sleep Period	
	2s	120s	default setting, good battery life moderate update speed
	2s	15s	improved response time, reduction in battery life
	2s	5s	maximum responsiveness, battery life as short as 3 mo.

Mesh Network Settings

The default mesh network settings should work for the majority of installations. The mesh network of the MetriLink system can be extensively modified to perform well in demanding applications. Contact JOWA USA's technical staff for help with non standard settings.

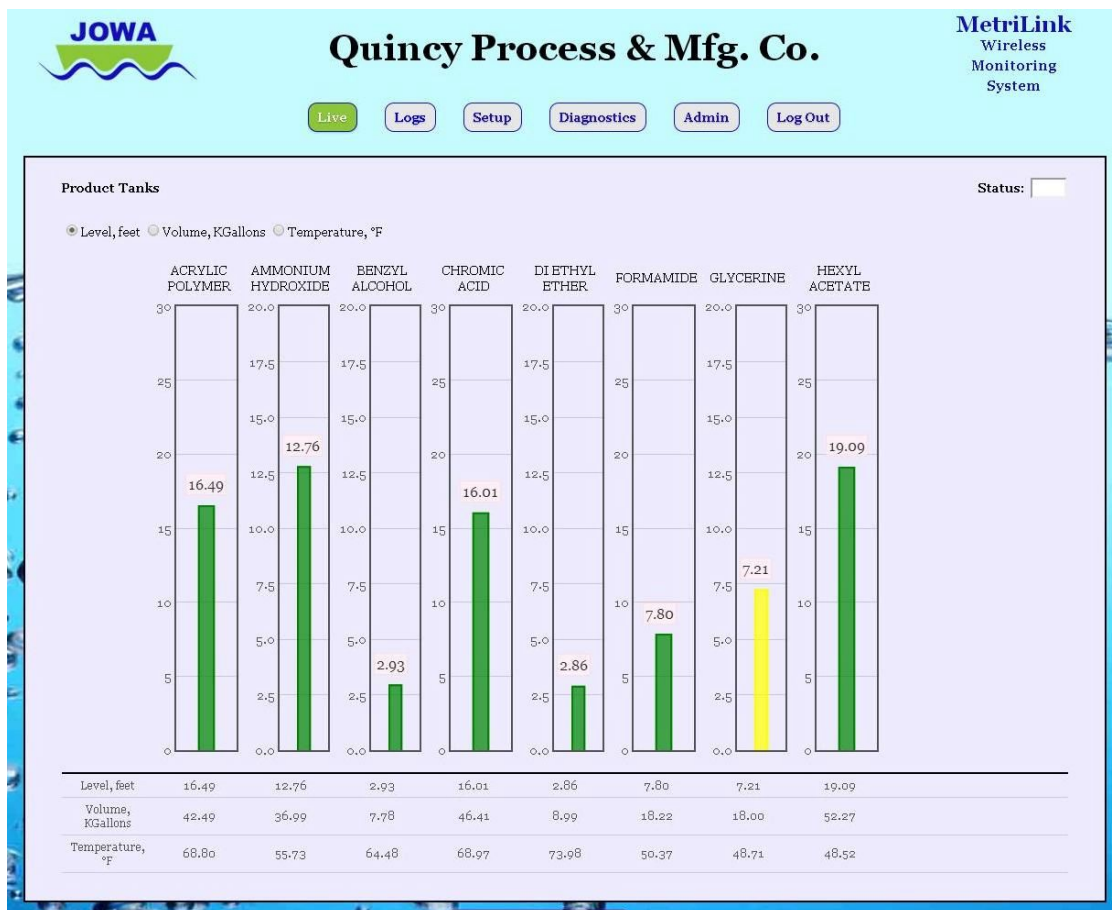
5.6 Viewing data

Data is presented on the "Live" pages. Each group is displayed on a separate page and each page can display data from 10 Field Units. Clicking the "Live" button will show a drop down list of available groups (only if more than one active group exists). Select the desired group the chosen Live page will open. A bar graph for each Field Unit occupies the center of the page. Three radio buttons above the bar graphs allows selection of what input from the Field Units will be displayed by the bar graph. Available inputs are; Level, Volume and Temperature

Below the bar graphs is a table with all inputs from each Field Unit.

To change the units of the displayed data navigate to the "Setup / System" page. On this page are fields to select units for Level, Volume and Temperature.

Bar graphs are colored green for Field Units that are communicating with the Base Radio. Should transmission with a Field Unit not be successful the bar graph color for this Unit will change to yellow. Should this condition exist or occur repeatedly the system might not be running properly. Refer to the Diagnostic section 8. on how to resolve this.



Warning! As the Field Units are part of a mesh network they all interact. Therefore a poorly performing unit can degrade the performance of the whole network. One possible consequence can be an excessive battery consumption of all units. Always follow the diagnostic procedure (par 8.) when warnings and/or performance problems are detected.

5.7 Recording of data

The Base Radio is capable of recording the data from the Field Units to its internal memory. This data can be exported to an external computer for further use.

Only data that have been selected to be tracked, will be recorded. To make this selection, navigate to the Setup / Field Units menu. Select the group to which the desired unit belongs and click on the "Edit Field Units" button. When the list of Field Unit appear, select the desired unit and an edit panel will open. Check the boxes on the "Track" row for the desired values. Complete the task by clicking "Save"

Field Unit Update

Name: REACTIVE WA

Group: Waste Tanks

ADC Enables

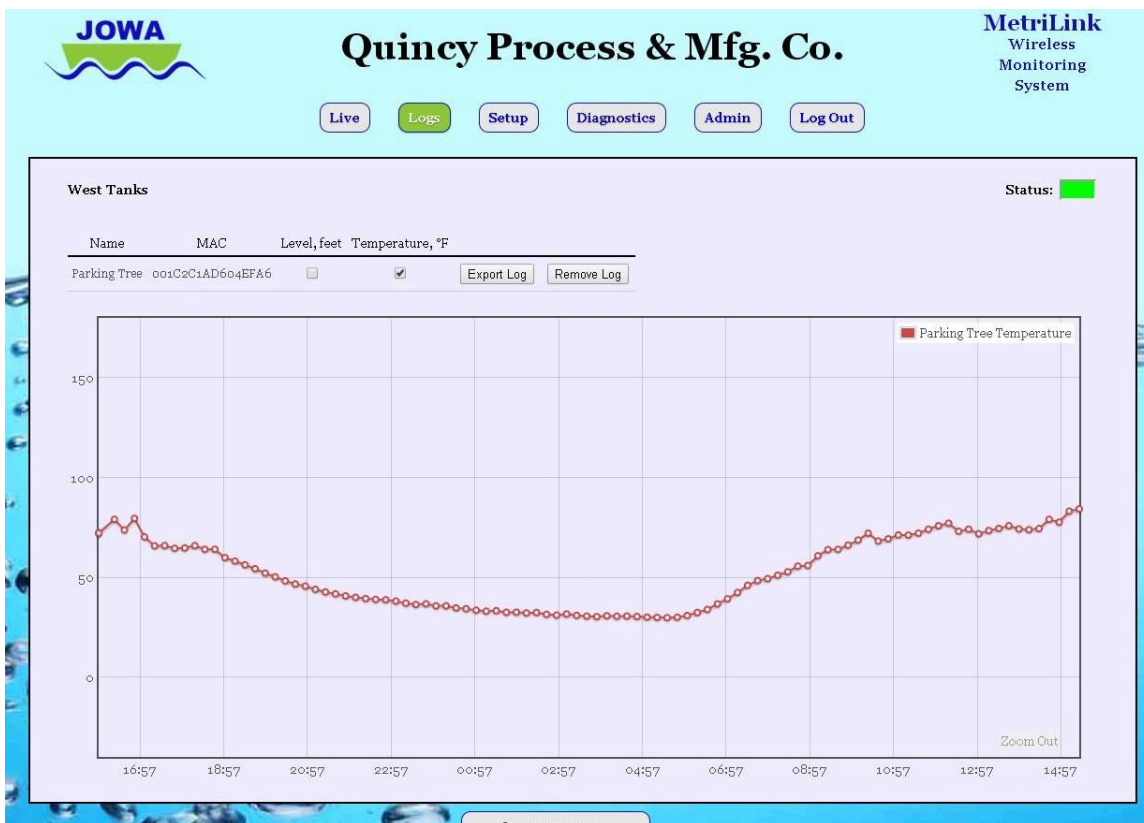
	Level, feet	Volume, KGallons	Temperature, °F
Display	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Track	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Change Tank/Sensor Parameters

Data is now being recorded. To view the recent data, navigate to the Logs menu and select the group from the drop down list. A chart window will appear with check boxes above for the available data.



Note: Only the values that have been selected to be "Tracked", are available to be charted and exported.



Viewing of recorded data

Checking the box for a variable will display the recent data in chart below. The amount of data that can be displayed is determined by the "Log Limit" set on the Setup – System page. Increasing this setting will slow down the system as more data needs to be accessed to update the chart.

For example: with a Sleep period of 6 minutes and a log limit of 240 the log window will display 240 points covering $240 \times 6\text{min} = 1,440\text{min}$ (or 24 hours).

Increasing the log limit will not instantly display more data points but will allow future points to be added to the log window until the now limit is reached. Thereafter the oldest points will be removed from the log window to make room for the new point.



Caution: Recording data uses space on the internal memory of the Base Radio and can slow the system down. Exporting data will also be slow if too much data is accumulated. Data is exported at a rate of 10,000 values per minute. For example: with 20 tanks recording level and temp every 2 minutes will generate 14,400 values per day. If a week is logged the export will take 10 minutes!



Note: All values selected to be "Tracked" are recorded and not subject to the "Log Limit". "Log Limit" only affects what can be displayed on the chart.

Exporting recorded data

Recorded data can be exported from the Logs page(s). Click on the "Export Log" to have the data from this unit exported to your "Download" directory. When using the Chrome browser a link to the file will be located at the bottom left of the screen. At the bottom right is a second link to the list of all downloads. When Firefox browser is used a file dialog box will pop up. Files are in "csv" [comma separated values] format and can easily be opened with Excel or simple text editor.

Deleting recorded data

Recorded data can also be deleted from the Base Radio. This is done by clicking the "Remove Log" on the Logs page for each group. There is one "Remove Log" for each Field Unit. Clicking this button will permanently delete all recorded data from this Field Unit only. Exported data files are not affected.

5.8 Error messages

In addition to the yellow bar graph color the system will post textual warning messages on the Live pages for problems that needs to be diagnosed.

Low battery warning; Should the battery voltage of any Field Unit fall below acceptable level a "Low Battery" warning will be issued.

RF communication warning; If one or more Field Units fails to report in during the normal time window the Base Radio will "Time Out". If the frequency of Time Outs exceeds acceptable level a "Excessive Timeouts" warning will be issued.

Should any of these warnings be posted we strongly recommend that the Diagnostic procedure be followed to determine the cause of the warning and proper actions be taken. See section 8.

6.0 Field Unit Installation

This section discusses both the mechanical and electrical aspects of installation of the Field Unit.

6.1 Mechanical Installation

The MetriLink Wireless Resistance Transceiver is a rugged device, but it will give much better service if installed with careful consideration as noted in this manual. They may be utilized for just about any installation so long as care is exercised to prevent exposing the sensing elements to excess stress or temperature. Installation practices have a lot to do with these service parameters and the life that you can expect from your MetriLink Wireless Resistance Transceiver. The main considerations for installation are covered below.

Give careful consideration to the environment where you will be installing your instrument. Avoid installations that expose the device to excess temperature, high vibration, considerable shock, or exposure to dripping condensate or corrosive materials. Also avoid installing the device in an unserviceable location.

Most often these problems can be avoided with some thought at the time of installation. The practices noted below are generally recommended, but they can only act as a guideline and cannot cover all possible variations. The final installation must be made at the discretion and approval of the user. You must be the judge of the actual installation.

6.2 Field Unit Positioning

Correct positioning of the Field Unit will ensure the best performance of the device. When planning the positioning of the Field Units there are a few parameters to pay attention to.

- Ideally the Field Unit should be placed inside the sensor housing and the antenna attached to the antenna plug in the sensor housing lid. See the adjacent figure. In special cases it might be necessary to remote mount the antenna to achieve reliable communication with the Base Radio.
- All Field Units should maintain a spacing of at least one foot.
- The line of sight range between a Field Unit and Base Radio is 3000 feet at the 250 kbps rate setting. Note that the amount of RF Noise present, obstructions, and the material of construction of the objects, reduces this range.
- Only place the Field Unit in ambient operating temperatures of -40°F to 185°F (-40°C to 85°C).



Warning! When placing the grey Field Unit down into the outer housing with the filter take great care not to kink or put excessive pressure on the antenna cable.

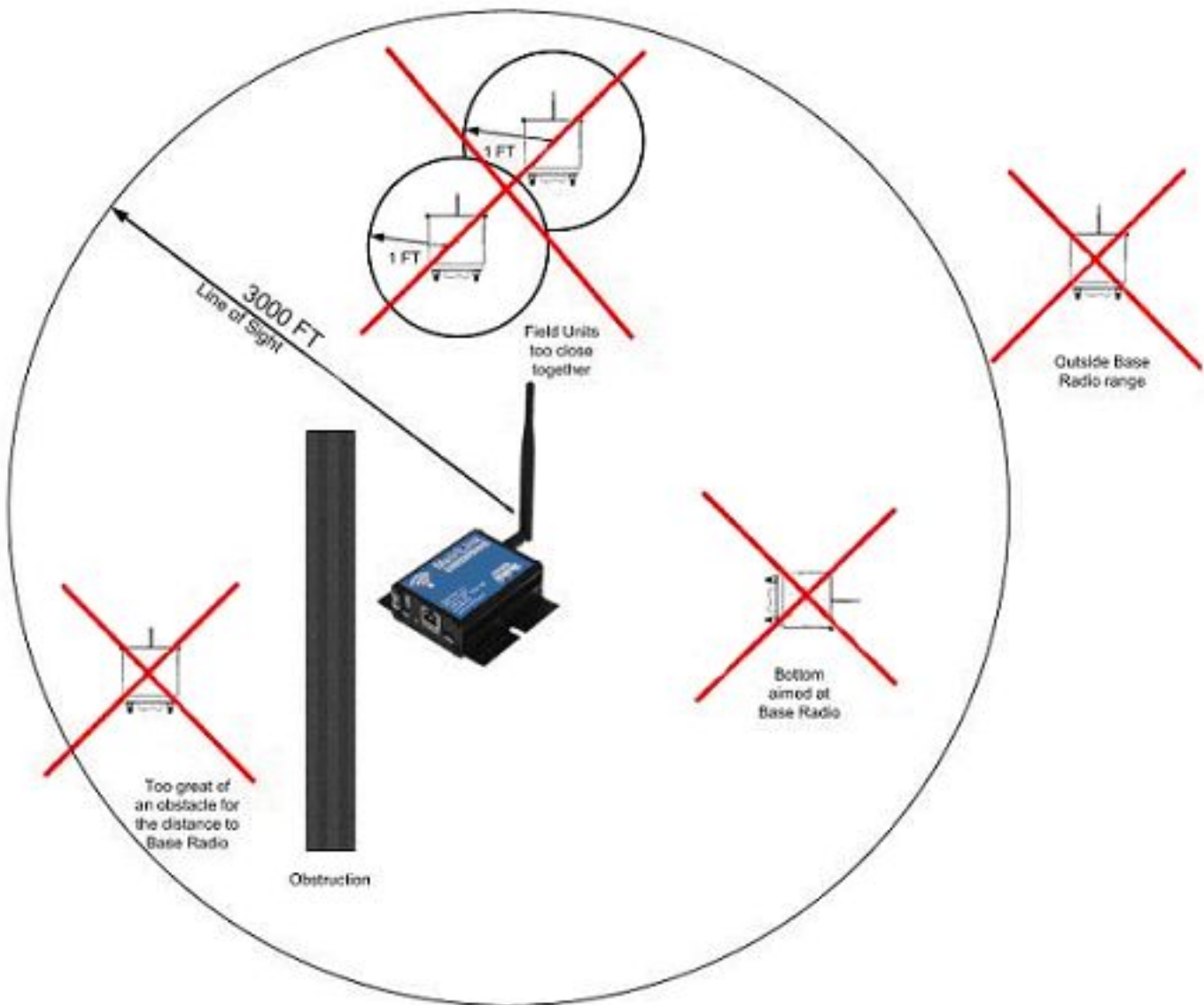


Figure 6.2: Examples of Incorrect Field Unit Positioning

Because there are so many setup possibilities we cannot cover them all. A correct setup would make sure that the above warnings are heeded, and that the Field Unit and Base Radio are capable of communication. The RF Placement Test section will help you to determine if you have selected the correct installation points and orientations for your application.

6.3 A Simple RF Placement Test

Remember, proper placement of the Field Unit will optimize your RF communication range and capabilities. Perhaps the best test to perform before mechanically mounting the unit is a quick hand held test.

To perform this test you should have a good idea of where the Base Radio will be placed (for more information see section 5.1). Put the Base Radio in this area and power it up. Now, make sure that the Base Radio and Field Unit are on the same RF Channel, Network ID and encryption key. See section 5.4.

Once both the Base Radio and Field Unit are configured to one another, make sure communications are established by using the Base Radio web interface. See section 5.3 and 5.4. Set the Wake Period to 2s and the Sleep Period to 6s. Make sure the Timeout Wake Period is 6s and the Timeout Sleep Period is 18s.

Now take the Field Unit to the sensor you wish to monitor. Remove the lid to the Field Unit and connect the antenna directly to it. Hold the Field Unit antenna in the approximate intended location and ensure your body, hands and arms are not blocking the path to the Base Radio. Press and hold the switch "S1" while monitoring the LED "D3". See figure below. The LED will light up while the Field Unit is in "wake" mode. If the Field Unit is communicating with the Base Radio the LED will flash once every 6s. If communication is not established, the LED will be lit for 6 seconds and off for 18s as the Unit is now in Time Out mode.



If communication is not established then the selected position is not a suitable location for mounting the device and measures need to be taken to improve the strength of the RF link. If your application allows, move to a different position and check again for communications. If your application only allows you to mount at this particular point and acceptable RF strength was found within 20' we recommend remote mounting the antenna and using a coax extension cable.

One alternative solution is to place a separate Field Unit as a relay station between the out of range Field Unit and the Base Radio. If reliable RF communication can not be achieved at several Field Unit locations it might be advisable to improve the location of the Base Radio. It is also possible to remote mount the Base Radio antenna using a coax extension cable. To select a better spot for the Base Radio, see section 5.4 for more details on this.

6.4 Electrical Installation



Figure 6.3: Resistance-tape / Field Unit Wiring

Mounting Instructions

- Remove Housing Cover from Housing
- Install the antenna on the Housing Cover
- Open the Field Unit and make sure the battery is plugged.
- Replace the lid and tighten the 4 screws snugly. Best to do this by starting all four screws partially and then tighten them all further and on the third round tighten them all the way.
- Plug Field Unit into sensor
- Attach the coax cable from the Housing Cover to the Field Unit.
- Very carefully nestle the Field Unit in the Housing ensuring that the coax cable does not get kinked or excessively stressed.
- Close the Housing Cover onto Housing and secure with the four screws.

6.5 Configuring Field Unit

Field Unit Setup

Each Field Unit is identified by the MAC address given to that particular unit. This address is set permanently by the factory and can be found on the label on the bottom of the unit. This MAC address will also be transmitted to the Base Radio and can be seen by selecting the Setup / Field Units menu.

In addition to the MAC address you can give each Field Unit a name and assign it to a group. This can be set on the "Setup - Field Units" pages.

Create New Group

Select	Name	Platform	Number of Field Units
<input type="radio"/>	Inactive Group	jowa	0
<input checked="" type="radio"/>	Waste Tanks	jowa	3
<input type="radio"/>	Product Tanks	jowa	8

Waste Tanks Update

Group Name:

Field Units

Name	MAC Address	Presence	Platform	Firmware	Software	Last Sync	Created	Error
REACTIVE WASTE	001C2C1AD604BEDC	True	JOWA-102-1.0	2.4.32	NODE_1.17	2011-12-20 21:07:21	2011-12-20 19:28:18	
WASH DISCHARGE	001C2C1AD604BED9	True	JOWA-102-1.0	2.4.32	NODE_1.17	2011-12-20 21:07:21	2011-12-20 19:38:14	
DETERGENT	001C2C1AD604BF61	True	JOWA-102-1.0	2.4.32	NODE_1.17	2011-12-20 21:07:21	2011-12-20 19:39:01	

Edit Field Units

Up Down Remove Save Cancel

Field Units are grouped so they can be displayed on separate pages when the number of units on one network gets large. The intent is to display the units from each group on a separate page on the "Live" pages. Do not exceed 10 Field Units per group. The order of the groups can be changed as can the order of the Field Units within each group.

Selecting the Setup / Field Units menu will open the Setup - Group page. Only one group is present by default. This is the "Inactive" group and is the group into which newly discovered Field Units gets placed. In order to display Field Unit data the Unit must be assigned to a group other than the "Inactive" one.

To create a group, click on the "Create New Group" button on the Setup – Group page. A panel will open up with a field to enter the new group's name. Click on "Save" and the new group will appear on the group list.

When a group is selected it can be moved up and down on the list with the buttons at the bottom of the edit panel.

Groups can be renamed by selecting the radio button for the desired group, entering the new name and clicking "Save". Similarly groups can be deleted with the "Remove" button.

Once a group's radio button is selected the Field Units in this group will be listed in the panel below the Group list. To edit one of these Units or reassign it to another group simply click on the "Edit Field Units" button to open the Setup – Field Units" page.

Select	Name	MAC Address	Presence	Platform	Firmware	Software
<input type="radio"/>	REACTIVE WASTE	001C2C1AD604BEDC	True	JOWA-102-1.0	2.4.32	NODE_1.17
<input type="radio"/>	WASH DISCHARGE	001C2C1AD604BED9	True	JOWA-102-1.0	2.4.32	NODE_1.17
<input type="radio"/>	DETERGENT	001C2C1AD604BF61	True	JOWA-102-1.0	2.4.32	NODE_1.17

Select the desired Field Unit's radio button and an edit panel opens. The panel includes a Name field that can be edited, a list box with the available groups to assign Field Unit to and two rows of check boxes. Check the appropriate boxes for the desired measurements. Check "Display" boxes to include the measurement on the "Live" page. Check "Track" to record the measurement for later export to PC. Complete any changes by clicking on "Save".

Also on the edit panel is a button "Change Tank/Sensor Parameters". Clicking this button opens a panel with fields for all the tank and sensor parameters. See the next two pages for more details on setting these parameters. Once the desired changes have been made to the parameters, click "Save" to complete the change.

ADC Constants

Level Constants

DTB: 10.0 * Distance to Tank Bottom, meters

N: 0.044 * Nipple height of sensor housing, meters

DTH: 0.088 * Distance to Top Helix, meters

AD: 0.125 * Actuation Depth of sensor, meters

SG: 1.0 * Specific Gravity of liquid being gauged, g/cc

ZL: 0.0 * Zero Level (offset adjustment), meters

RS: 20000.0 * Resistance of Sensor, ohms

RG: 1000.0 * Resistance Gradient of sensor, ohms/meter

RPL: 5000.0 * Value of level pull up resistor, ohms

Volume Constants

Tank Type: Constant Area Tank

Area: 41.0 * Specify Area, meters²

Temperature Constants

DTL: 19.4 * Distance from sensor "zero" to Temperature element, meters

ZT: 0.0 * Zero Level (offset adjustment), °C

RPT: 4020.0 * Value of temperature pull up resistor, ohms

Save Cancel

To rearrange the order of the Field Units on the “Live” pages navigate to the Setup / Field Units page, select the Group to be arranged and, after selecting the radio button for the Field Unit to be moved, click on the Up and Down buttons. The top Unit in the list will be displayed to the left on the Live page and the remaining Units following to the right.



Note: Groups can also be rearranged in a similar way on the Setup – Group page.



The data from Field Units in the “Inactive” group can not be displayed on the Live pages and is not recorded. This allows archiving Units that are still present on the network but are not used. It also prevents unwanted Units from appearing on the Live pages.

Selecting the Sensor Constants

The reference point from which all measurements are to be made is the mounting flange for the sensor housing (most often the Stillpipe Flange) or in the case of the Aquatape, the Top of the pipe thread.

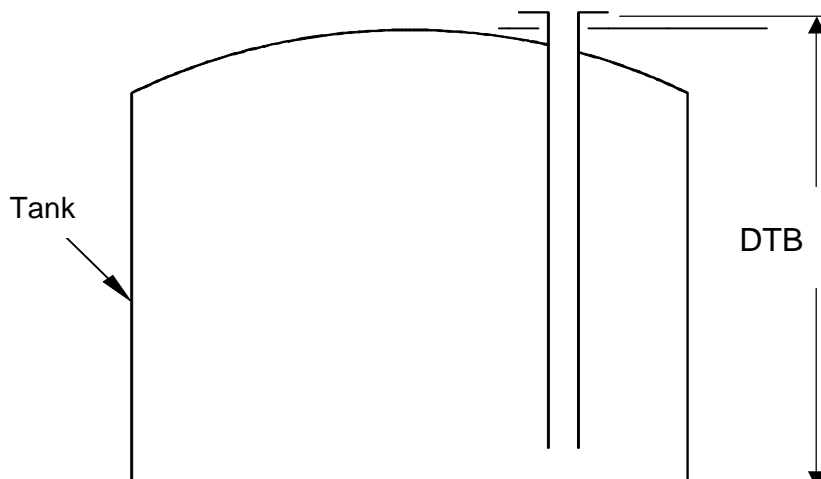
Metritape Level and Temperature Sensor Setup

Each field unit must be set up for the Metritape sensor used and the tank where the sensor is installed. The information you will need are DTH, AD, RS and RG from the Sensor Tag (attached to the sensor) or Sensor Log (shipped with each sensor). If the sensor includes a temperature option then DTL will also be provided.

You will also need to determine DTB from the tank (see drawing below) and the SG of the liquid in the tank. SG is the specific gravity of the gauged liquid in grams/cubic centimeter. This is 1.0 for fresh water.

Finally you will need N (set to 0.044m for Petrotape and Chemtape housings, set to 0.000m for Aquatape housings).

The setup list also includes ZL, ZT and RPL and RPT. **DO NOT CHANGE RPL and RPT from their default values of 15,000 and 4020 Ohms respectively !** ZL and ZT can be changed slightly to adjust out a zero offsets if needed.



To set these values, navigate to the Setup / Field Units page, select the and click on the desired unit's radio button. The window expands to show the ADC Constant pane. Edit the values and click on Save.



Note: If a sensor is replaced then the RG / RS calibration value is likely different and the ADC constants for this Field Unit should be updated.

Level Constants

DTB: Distance to Tank Bottom, meters
 N: Nipple height of sensor housing, meters

JOWA USA Sensor Housing	Nipple height Meters
AGS/SH666	0.00m
PGS/SH887	0.044m
CGS/SH887	0.044m
SH/SS887	0.044m

DTH: Distance to Top Helix, meters
 AD: Actuation Depth of sensor, meters. This represents the head of water pressure required to close a contact. This value is located on the sensor tag or the sensor log.
 SG: Specific Gravity of liquid being gauged, in grams / cubic centimeter
 ZL: Zero Level (offset adjustment), meters
 RS: Overall Resistance of Sensor, ohms
 RG: Resistance Gradient of sensor, ohms/meter. This value is located on the sensor tag or on the sensor log.
 RPL: Value of level pull up resistor, ohms **DO NOT CHANGE from default value of 15,000 Ohm.**

Temperature Constants

DTL: Distance from sensor "zero" to Temperature element, meters
 ZT: Zero Level (offset adjustment), degrees Celsius
 RPT: Value of temperature pull up resistor, ohms **DO NOT CHANGE from default value of 4020 Ohm.**

You will also need to determine DTB (Distance to Tank Bottom). This is measured from the housing bottom to the tank bottom (see drawing below) and the SG of the liquid in the tank. SG is the specific gravity of the gauged liquid in grams/cubic centimeter. This is 1.0 for fresh water.

Finally you will need N (set to 0.044m for Petrotape and Chemtape housings, set to 0m for Aquatape housings).

Volume Constants

The MetriLink Base Radio can also calculate tank volume for Constant Area, Upright Cylindrical, and Horizontal Cylindrical tanks. Select the desired tank type and enter the required parameters:

Constant Area Tanks

Area: Area of tank, square meters

Upright Cylindrical Tanks

Diameter: Tank diameter, meters

Horizontal Cylindrical Tanks

Diameter: Tank diameter, meters

Length: Horizontal length of tank, meters.

6.6 Setting a Measurement Offset

If the tank measurements and sensor constants are accurately entered the level and temp readings should be very close to actual conditions. There may occasionally still exist a need for small adjustments and the LZ and TZ constants can be set to accomplish this. See the previous section on how to change these settings.

7.0 Maintaining the Field Unit

The MetriLink Wireless Transceiver is extremely easy to maintain in that it requires no periodic calibration or system checks. The Field Unit has a self diagnostic system which is constantly checking the internal system for you. If any errors are found they are reported to the Base Radio. A simple yearly visual inspection for the following is all that is needed:

- Is the Field Unit antenna still securely fastened to the Housing Cover?
- Is the Housing Cover securely fastened to the Housing?
- Are there any visible cracks or residue build-ups on the antenna or Housing?
- Has anything about the application changed from the original intended use?

7.1 Changing the Battery

The battery will need to be changed within one month of seeing a 'LOW BAT' message on the Base Radio web interface. Changing the battery is a simple process, but it needs to be carefully followed to ensure the unit maintains it's seal against the elements and that the cabling is not damaged..

Make sure you have the correct replacement battery: TADIRAN™ Lithium Inorganic Battery (non-rechargeable) size 'C' – 3.6Volts #TL 5920/B. JOWA USA p/n 912 5010.

First open the Sensor Housing by removing the 4 screws and the cover. Open the Cover carefully as it is attached to the antenna cable and the Field Unit. Unscrew the coax antenna cable from the Field Unit. Lift up the Field Unit and disconnect the Sensor cable.

Next, remove the 4 cover screws on the top of the Field Unit with a Phillips screwdriver. Remove the cover. Be careful not to rip the gasket.

Unplug the battery cable from the circuit board then unclip the battery from the board. Note the orientation of the old battery!

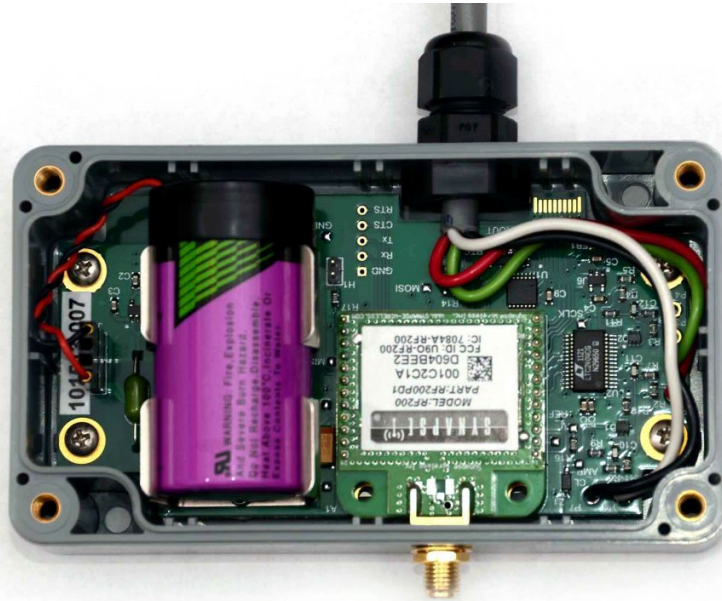


Figure 7.1 Battery in place.

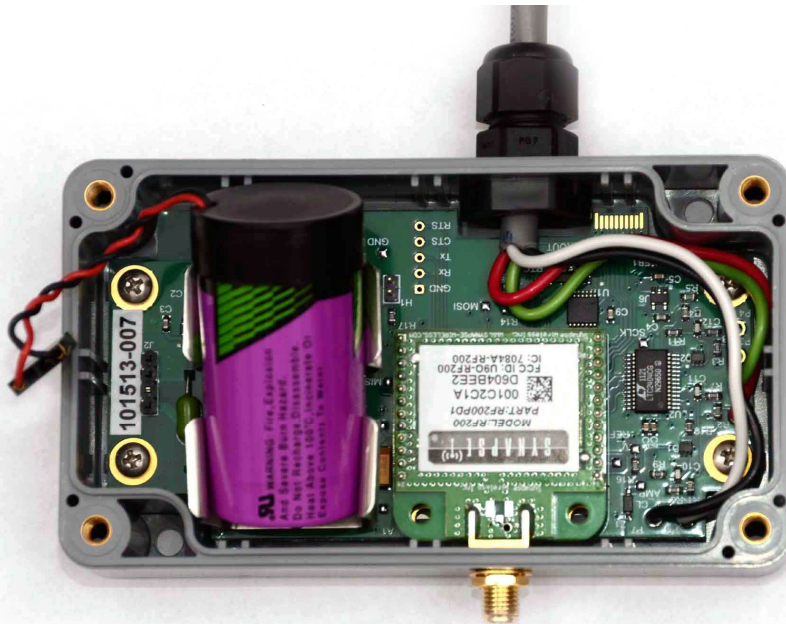


Figure 7.2 Battery disconnected and partially removed.



Figure 7.3 Battery removed.

Install the new battery into the clips. Ensure that the black rubber cap on the wire side of the battery is clear of the clip.

Connect the battery plug to the connector on the circuit board. Pay attention to the connector orientation. It will only fit in one direction. Observe the LED on the circuit board when plugging in the battery. It should flash red if the battery is good and the unit boots up properly.

Replace the Field Unit cover and tighten the 4 screws snugly. Best to do this by starting all four screws partially and then tighten them all further and on the third round tighten them all the way.

Plug Field Unit into sensor

Attach the coax cable from the Housing Cover to the Field Unit.

Very carefully nestle the Field Unit in the Housing ensuring that the coax cable does not get kinked or excessively stressed.

Close the Housing Cover onto Housing and secure with the four screws.

Dispose of the old battery properly in accordance with your local regulations.

8.0 Diagnostics

8.1 Trouble connecting browser to the Base Radio

Verifying that the Base Radio is running

Do you have power to the unit? You should be able to see an orange glow inside the box if you look thru the cracks around the Ethernet connector.

Is the Base Radio program running? Unplug and replace the power plug and observe the "B" LED. During normal startup the LED should go thru the following sequence:

Off for 10 – 35 seconds. Varies depending on network connection time.

Red for approximately 1.5s.

Green for 5 –10s.

Red for less than 1s.

Off for 5s.

Regular 1s green flashes separated by the configured sleep time.

A more thorough diagnostic can be done with a serial terminal. See section 8.4.

Verifying that the Base Radio is connected to the Ethernet network.

The green LED on the Ethernet connector should be lit. If not, check that you have a good connection to the Ethernet network. In addition to the steady green LED the orange activity LED should be flashing.

What IP address is the Base Radio assigned? **Dynamic IP addressing;** if the unit is connected to a network with a DHCP server then it will receive its IP address from the server. Ask the network administrator which IP address was assigned. **Static IP addressing;** if the unit is not receiving an address it will revert to its default static address of 192.168.1.111.

If the browser does not bring up the MetriLink log-in page when the correct IP address is entered then attempt to "ping" this address from a terminal window on your PC. See section 5.3. for more details on the ping command. If the "ping" is unsuccessful then either the Base Radio has not booted up correctly or there is a network problem. Verify the network setup with your network administrator. See section 8.4 on how to connect a terminal to the Base Radio for further diagnostics.

If the "ping" verifies that the Base Radio is active on the network and the browser can't connect to the Base Radio the internal program may not have started properly. Refer to section 8.4 on how to continue diagnostics with a serial terminal.

8.2 Inability to connect a Field Unit to the Base Radio



Warning! If the Field Units have been running for an extended period of time with no signal from the Base Radio (the Base Radio is off or not present), the Field Units will enter an extended sleep mode. Sleep times can be in excess of 30 minutes. Unplugging and reconnecting the Field Unit's battery will cause them to transmit to the Base Radio immediately.

Verifying that the Field Unit battery is not depleted

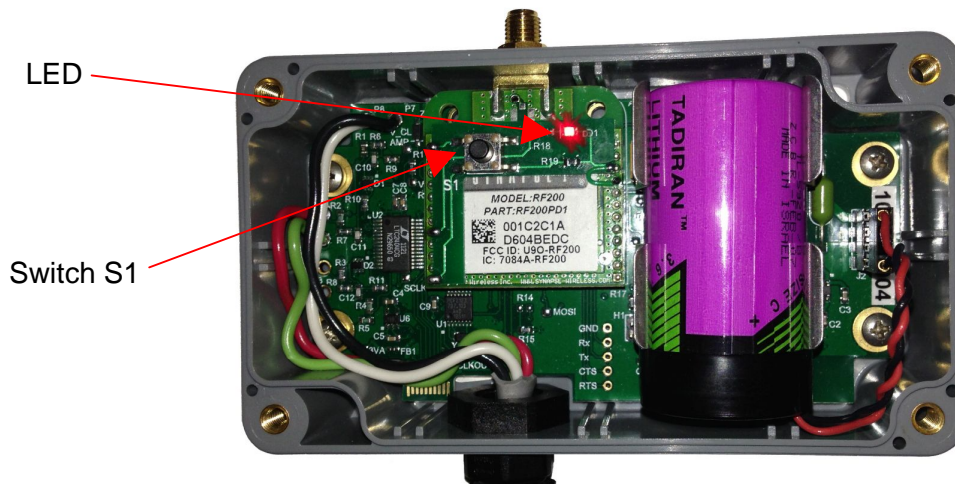
Unplug the battery connector from the Field Unit and reconnect it while observing the LED "D3". During power-up the LED will flash briefly. If the LED does not flash then the battery is likely depleted.

If the Sleep Period is short and the unit is not in extended sleep mode proper operation of the unit can easily be verified. Press and hold the switch "S1" on the Field Unit while monitoring the LED "D3". If the battery voltage is acceptable and the Unit is running, the LED on the Field Unit circuit board will be lit when the Unit is awake. In normal operation the flash will be less than 1s and repeat every "Sleep Period" as set with the Web Interface.

Resetting Field Unit to factory default settings

If communication with a Field Unit is lost and can't be restored by cycling power off and on, it might have RF parameters different from the Base Radio. To restore the Field Unit to factory default settings, perform the following procedure:

- Disconnect the battery.
- Press and hold the switch "S1".
- Reconnect the battery.
- Wait a few seconds and let go of the switch.



If non-standard RF settings are used on the Base Radio then additional steps will be required to reconnect the Field Unit. See section 7.5.

8.3 Low Recent Sync Rate warning

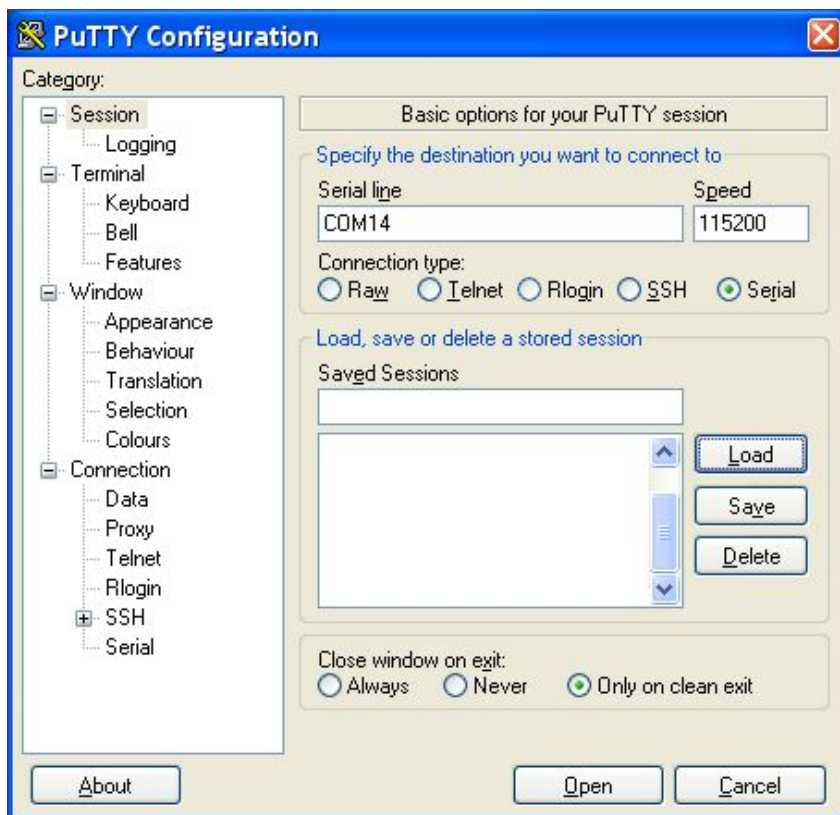
"low Recent Sync Rate" warning indicates that during more than 20% of wake cycles at least one Field Unit did not successfully communicate with the Base Radio. This will cause ALL Field Units to stay awake much longer than normal thus depleting the battery quicker. Navigate to the Diagnostic page and review the Time Out ratio for each Field Unit to determine which Unit is failing to communicate properly. Ensure that this unit's battery voltage is reported as above 3.25V. If not, replace the battery. Verify also the signal strength. If it is below 25% we recommend taking steps to improve RF communication. See section 6.3.

8.4 Connecting to the Base Radio with a PC terminal

To diagnose problems with the Base Radio, change the default static IP address or perform advanced changes it is necessary to connect a terminal. This can be done with either a USB serial or an Ethernet cable. The benefit with the USB option is that the boot process can be monitored.

Both options use a terminal program running on a PC. We recommend using Putty.exe that can be downloaded from <http://www.putty.org/>. It is a simple executable that does not need to be installed. Just copy to disk and run.

Start Putty. A security warning that the publisher is unknown may appear. Select "Run" to proceed. Once Putty has been launched the window below will open.



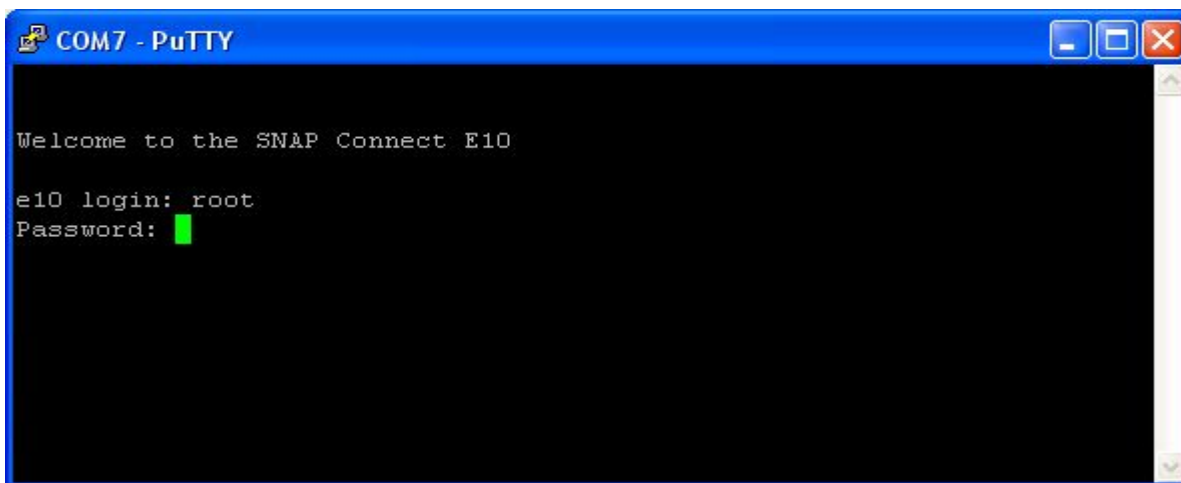
Connecting in serial mode

To connect using a serial link, connect the Base Radio to a PC with the USB cable that was supplied with the unit. This cable is normally used to power the Base Radio. Power will be provided by the PC thru this cable in addition to communication.

Once the USB cable has been connected Windows will assign a Comm port. In Windows 7 a driver needs to be installed. You should get a pop up window stating that "Device driver software not successfully installed". Click on this box and follow directions. An internet connection is needed for this.

Go to Windows device manager to see which comm. port number got assigned. Click "Start" then right click on "Computer" (for Win XP its "My Computer") and click on "Manage". Finally click on "Device Manager". Scroll down to ports and they should be listed.

Select Serial. The assigned Comm port and Speed as 115200. Press “Open”. A terminal window will open.



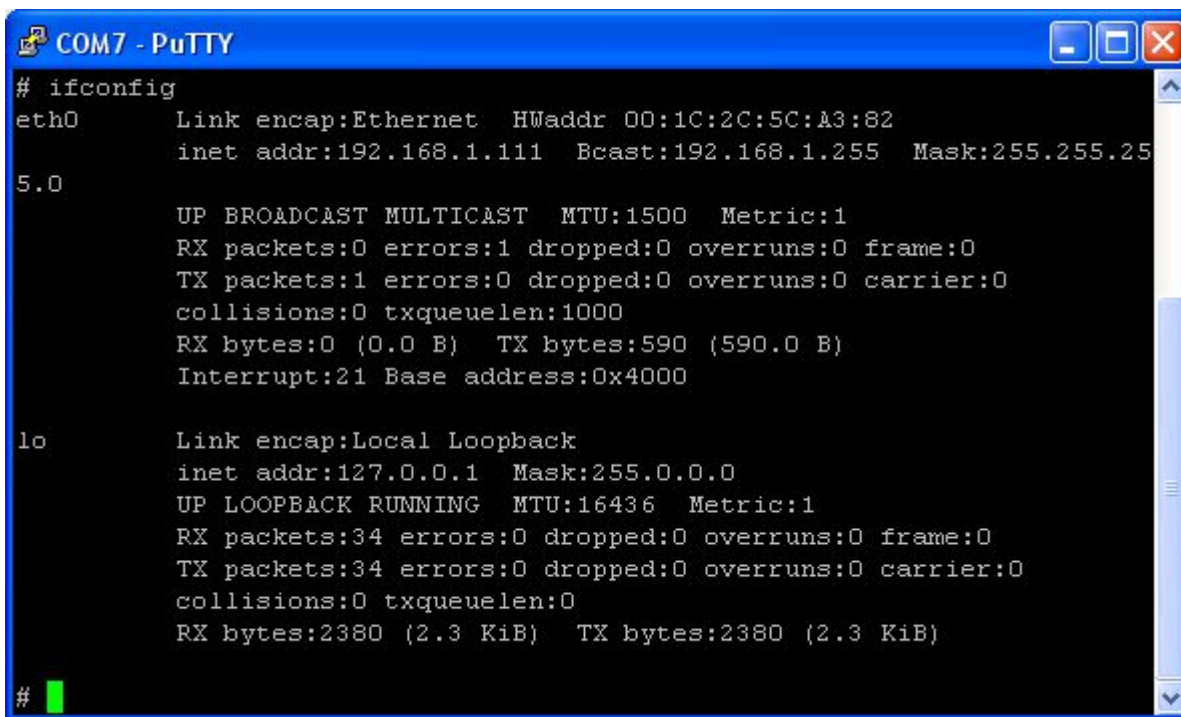
```
COM7 - PuTTY

Welcome to the SNAP Connect E10

e10 login: root
Password: 
```

Press “Enter” to get the login prompt shown. Type “root” (without the “ ”) and press Enter to get prompt for password. Default password is “jowausa”. Press Enter and the Linux # prompt will appear.

To view the current IP address type ifconfig and Enter.



```
COM7 - PuTTY

# ifconfig
eth0 Link encap:Ethernet HWaddr 00:1C:2C:5C:A3:82
    inet addr:192.168.1.111 Bcast:192.168.1.255 Mask:255.255.255
    5.0
    UP BROADCAST MULTICAST MTU:1500 Metric:1
    RX packets:0 errors:1 dropped:0 overruns:0 frame:0
    TX packets:1 errors:0 dropped:0 overruns:0 carrier:0
    collisions:0 txqueuelen:1000
    RX bytes:0 (0.0 B) TX bytes:590 (590.0 B)
    Interrupt:21 Base address:0x4000

lo Link encap:Local Loopback
    inet addr:127.0.0.1 Mask:255.0.0.0
    UP LOOPBACK RUNNING MTU:16436 Metric:1
    RX packets:34 errors:0 dropped:0 overruns:0 frame:0
    TX packets:34 errors:0 dropped:0 overruns:0 carrier:0
    collisions:0 txqueuelen:0
    RX bytes:2380 (2.3 KiB) TX bytes:2380 (2.3 KiB)

# 
```

The current IP address is listed on line 2 after “inet addr:”.

To view the boot log simply type “reboot” and press Enter. At the end of the boot log the login prompt will reappear.

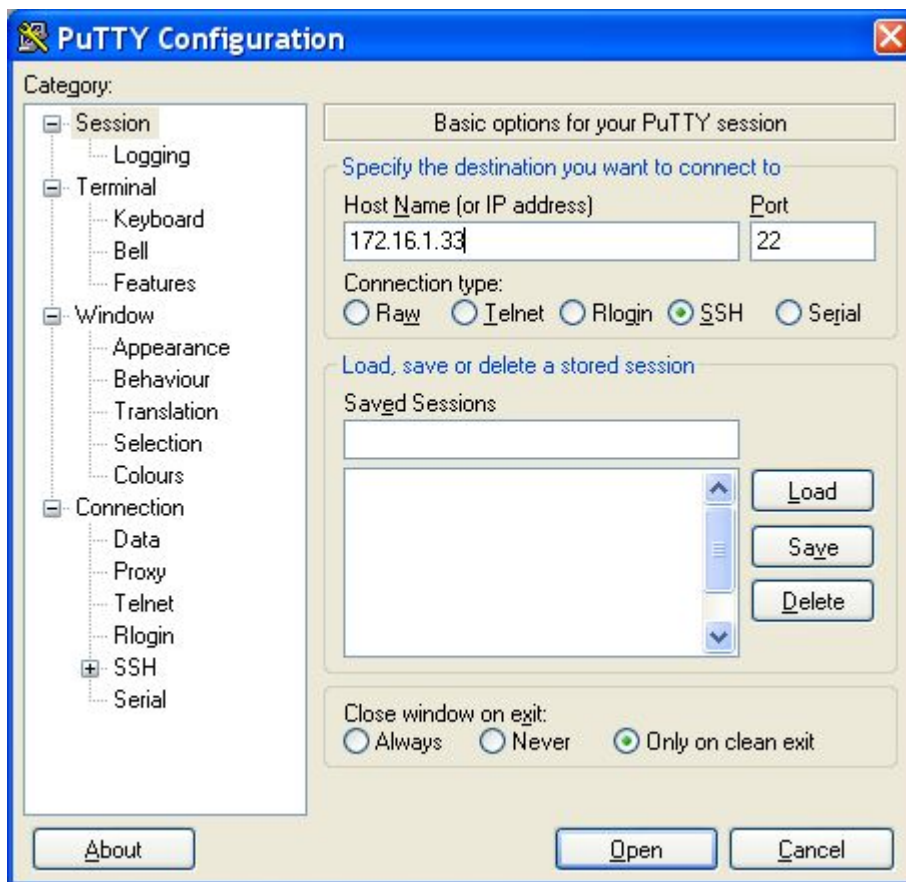


Note: The Base Radio must be connected to an Ethernet network for the IP address to be assigned and reported.

Connecting in Ethernet mode

To connect with an Ethernet terminal the Base Radio must have an established connection with the PC over an Ethernet network. It could be as simple as an Ethernet crossover cable and a static IP address or a large network spanning the globe. In either case the Base Radio's assigned IP address must be known.

Start Putty and the configuration window appear.



Select SSH, enter the Base Radio's IP address (leave the port at 22). Press "Open" and the black terminal window will appear. The "Login as:" prompt will appear without any needed keystrokes. Enter "root" for user name and "jowausa" as password.

A warning might pop up regarding the Ethernet connection. This is normal the first time a new connection is made between a PC and a new Base Radio.

Basic terminal tasks

To verify that the MetriLink program is running type "top" and press Enter. A list of running programs will appear as well as other useful information. When the MetriLink program is running there should be two instances of "GATE" shown. Press "Ctrl" and "C" to exit to the # prompt.

To change the default fallback static IP address the file /etc/init.d/S40network needs to be edited.



Warning! Editing files on the Base Radio can render it inoperable and it may need to be returned to the factory to be reprogrammed. Do not attempt to perform edits unless familiar with this kind of work. Prior to making any edits make sure to create backup copy of the file to be edited.

To edit the S40network file first make a backup copy; at the # prompt type
“cp /etc/init.d/S40network /etc/init.d/S40network_bu” then Enter. Note the space after “cp”.

- To open the file with the “vi” editor; vi /etc/init.d/S40network
- To edit; use down arrow key to go down to the line starting “/sbin/ifconfig eth0..”
- Press “i” to enter edit mode. Use left arrow to position cursor at the beginning of the IP address. Use “Delete” key to erase old address then type in the desired address.
- Use up arrow to go up one line and perform edit on the “echo” line as well.
- Press “Esc” to exit edit mode.



Note: Pressing “Ctrl” and “Z” will exit the editor without saving changes.

- Type “:” and Enter then “w” and Enter to write changes to disk.
- Type “:” and Enter then “x” to exit the editor.

A reboot is necessary for the IP address change to take effect.

Should you need to restore the original file you can overwrite the file with the backup file by typing “cp /etc/init.d/S40network_bu /etc/init.d/S40network” then Enter.

8.5 Recovery of Field Unit after reset with Base Radio not on channel 4

When a Base Radio is using a channel other than channel 4 it will not detect a “reset” or a new factory default Field Unit. In this case it will be necessary to use a Base Radio set to channel 4 to switch the Field Unit to the correct channel. This can be done in two ways:

- The most common reason for using channels other than 4 is that two MetriLink systems are present in the same location. Normally one of the systems is using the default channel. Simply log in to the system using channel 4, find the new or reset Field Unit in the “Inactive” group and change it's channel to the desired number.
- The second method is to temporarily change the whole MetriLink system to channel 4, find the new or reset Field Unit in the “Inactive” group, move it to a desired active group and then return the whole system back to the original channel.



Warning! Be very careful changing channel on a system with many Field Units. First verify that all Field Units are communicating well and that battery voltages are well above 3.25V. After changing channel, ensure that all Field Units are present on the new channel. Should Field Units be lost in this process refer to section 8.6.

8.6 Recovery of system after incomplete channel change

Should a MetriLink system end up in a state where Field Units are on two or more channels it can still be recovered by following the steps below:



Note: Field Units will not change channel without being commanded to do so. Units are either lost by not following a change in network channel, by having their channel manually changed while in the “Inactive” group or as a result of being reset. In either of these cases the channels that units might be stuck on are few and should be known to the operator of the system [used channels].

Move all Field Units still on the [active] Base Radio channel [communicating Units] to the "Inactive" group. This will ensure that they do not follow when the Base Radio channel is changed to recover the other Field Units [lost Units].

Make VERY sure to "Remove" all the "Missing" units from the active groups. Failure to do so will make it impossible to change the Base Radio channel as it will now wait for the "Mission" units to acknowledge the channel change command.

Change the RF network channel from the [active] to the first of the channel(s) where the "lost units" are suspected to be. Navigate to the "Inactive" group and look for the "lost units".



Note: Keep in mind that the "lost units" are most likely in extended sleep mode. It will be necessary to wait at least "Timeout Sleep Period" to capture all "lost units". See the RF network setup page for the set length of this time.

Once "lost units" appears in the "Inactive" group, click on "Edit Field Units", select the first found unit and change it's channel to the "active" channel. Repeat this for all found units.

If additional Field Units are still lost and there are other "used channels", repeat the above process with these other channels.

The "Inactive" group should now have no remaining Field Units showing. (Other MetriLink system's units may be in the "Inactive" group. This can be ignored as "Inactive" units will not be commanded to change network parameters). Furthermore, all the "communicating units" should be reported as missing. They are still on the [active] channel and can not communicate with the Base Radio until it's channel is returned to the "active" channel.

Return the Base Radio to the "active" channel. All the previously found units should now appear in the "Inactive" group.

Finish the recovery by returning the found units from the "inactive" to their original group(s).

Technical Specifications

MetriLink Field Unit

Model: MWT Versions 1.18 or later

Sensor Options

Resistance-tape level sensor up to 60 feet long (18.3 meters)

Resistance-tape level-temp sensor up to 60 feet long (18.3 meters) with RTD temperature option.

Output Characteristics

See the Wireless Base Radio description.

Accuracy

± 0.5 ohms

Ambient temperature effect of 10 ppm per °C

Power Characteristics

Self-contained Power

'C' Size 3.6 V Lithium Battery

Battery life is inversely proportional to the update rate. A typical installation of up to 25 transceivers with an update rate of once every 2 minutes would have a battery life of 3 years.

RF Characteristics

2.4 GHz Spread Spectrum (802.15.4 Channels 11 through 26), FCC certified ISM license-free band

Up to 3000' range from base radio with clear line of sight; 500' to 1000' range with obstructions

The RF module in each field unit is individually tested and calibrated over the full temperature range to ensure reliable wireless operation

Network Characteristics

The transceiver runs an operating system with advanced mesh network functionality.

The link settings are optimized to balance battery life and signal reliability.

The settings can be changed to better suit unique installations such as high transceiver density or a large number of transceivers out of range of the base radio.

Self-Diagnostics

Low battery alarm – indicates the need to replace the battery (approximately one month warning)

Contains self-checking software and hardware that continuously monitors the operation. Any sensor or device parameter out of spec is identified and reported

Operating Temperature Range

-22°F to +140°F (-30°C to +60°C)

Compliant to:

FCC CFR-47 Part 15

Weight:

8 oz. (0.23 kg)

Housing:

NEMA 4X; ABS. 2.5" x 4.5" x 1.5" (6.35 x 11.43 x 3.81 cm)

Technical Specifications

MetriLink Base Radio

Model: MWB Versions 1.18 or later

Power Characteristics

External power supply 100 - 240 VAC, 0.15A, 50/60 Hz

RF Characteristics

2.4 GHz spread spectrum , FCC Certified ISM license-free band

Up to 3000' range to field units with clear line of sight; 500' to 1000' range with obstructions

The RF module in each field unit is individually tested and calibrated to ensure reliable wireless operation

Output Options

Web server with Ethernet/TCP/IP
Modbus over TCP/IP

Self-Diagnostics

Contains extensive self-checking software and hardware that continuously monitors the operation. Any sensor or device parameter out of spec is identified and reported

Physical Characteristic

Nema 3 enclosure for mounting in control room.
3.5 x 2.5 x 1.2 inches (8.9 x 6.35 x 3 cm)

Operating Temperature Range

-22°F to +140°F (-30°C to +60°C)

Weight:

6 oz (170 grams)

